A Novel Thermal Diffusivity Measurement Technique

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We have developed a novel technique for the measurement of thermal diffusivities (in liquids and solids). The geometry for these measurements is a thin disk of the material for testing. This technique relies on a mathematical reduction of the analytical solution of this disk geometry, utilizing a unique heated area, to temperature measurement positions. Using the resulting formulation, the (complicated) and unstable Bessel function solution is reduced to only three terms, one of which is a constant. The thermal diffusivity is obtained by taking the difference of the temperature versus time at three locations. In practice, due to the fact that the third term becomes negligible after a short time, three values of the thermal diffusivity are obtained. Also, exact timing between the heating pulse and the measurement time is not required. This technique will be used for determining the thermal diffusivity in molten II-VI melts. The thermal diffusivity in these systems is typically lower than that of available container materials. Thus, effects of heat transfer through the container itself can be appreciable. Obtaining three, essentially independent, measurements simultanesouly will give us better confidence in our results. We have applied this methodology to graphite and boron nitride determinations with good results.